

4.3.1 Types of light water reactors (LWRs)

By far the greatest fraction of nuclear reactors used to produce power around the world belong to the class known as light water reactors (LWRs), in other words reactors that utilize *light* water (as opposed to *heavy* water) as the moderator and primary coolant. To be self-sustaining neutronically, a LWR with natural uranium fuel must use heavy water as the moderator in order to maintain the neutron flux. The Canadian-designed CANDU heavy water reactor operates on this basis and is described in more detail in section 4.8. LWRs, on the other hand require enriched uranium fuel in order to be self-sustaining. However, because light water absorbs neutrons as well as slowing them down it is less efficient as a moderator than heavy water or graphite.

Besides serving as both moderator and primary coolant, water has many advantages in this context. It is inexpensive and the technology of water cooling is very well known and tested; it also has a high heat capacity and a low viscosity so that the heat can be removed with relatively low flow rates and pressure drops. Burnable poisons that absorb neutrons are often added to the primary coolant water to provide some additional control over the reactivity and to even it out over time. Most importantly, in most (though not all) designs of LWRs, boiling of the water within the core leads to a decrease of reactivity and serves as an automatic reactor shutdown mechanism (see section 7.4).

Various types of light water reactors have been developed in the past decades. These can be subdivided into two principal types, namely Pressurized Water Reactors (PWRs) and Boiling Water Reactors (BWRs) that are described in sections 4.3.2 and 4.3.3.